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XIV.

MEAN RIGHT ASCENSIONS OF 133 STARS NEAR THE NORTH POLE, OBSERVED IN 1882 AND 1883, AT THE FIELD MEMORIAL OBSERVATORY OF WILLIAMS COLLEGE.

By Truman Henry Safford.

Presented April 9, 1884.

The Observatory of Williams College is at present composed of two buildings at some distance apart. The old, or Hopkins Observatory, contains a Clark equatorial of 7½ inches aperture, whose mounting by another maker is old and unsatisfactory, and a Simms transit of 3¾ inches aperture, of ancient date, and in need of repairs. These instruments are employed for practice by the students, to whom the situation in the College grounds is convenient; but their horizon is much encroached upon by trees and buildings. This is the oldest observatory now in use in this country.

The newer, or Field Memorial Observatory, now consists of an iron house, containing the Repsold meridian circle, with which the following observations were made. The situation of this house is better adapted to observation; it is upon a slight elevation about a quarter of a mile from the College buildings, with a horizon bounded only by the neighboring mountains, Greylock in the southeast, the Taconics of New York in the west, and the hills of Vermont in the north. The instrument, of 4½ inches (French) in aperture, was completed in 1881; but the building was delayed quite needlessly by the contractors, so that the mounting did not take place until June, 1882, and the observations here given were begun a few weeks later. The intervening time was spent in getting the instrument into proper adjustment, and in the business of the annual Commencement. A few observations were made before the focal adjustment; these have not been reduced, except to rate the clock, which is an old one, removed from the Hopkins Observatory.

The new building, the instrument, and the fund which renders it possible to carry on astronomical observations, are the gifts of the same gentleman, the Hon. David Dudley Field, of New York City, well known in all civilized countries for his services to international jurisprudence.

The series of observations here presented is, it is hoped, the beginning of a large catalogue of stars. It is published in this form in order to set forth some principles, which, as I believe, represent the present state of practical astronomy with regard to the construction of a secondary catalogue; and to interest other observers in the application of these principles.

These observations are also intended, in connection with earlier ones upon the same stars, to meet a definite practical necessity for an extensive catalogue of polar right ascensions for various purposes of practical astronomy and geodesy. There are many observations whose final discussion, especially with respect to systematic corrections, will need to be based upon a combination of such catalogues as the one here presented; and the need of more such, especially for the latest epochs, is sensibly felt by all who have been obliged to make time-observations in the field for telegraphic longitudes. This is especially true in our Western Territories; the telegraphic communications are often precarious, and an accurate catalogue which enables the astronomer to determine his time, by portable instruments, in half an hour, with the precision of a fixed observatory, would often be of great assistance towards economy of labor.

I have already published such a catalogue of polar right ascensions for 1865, and its repetition on a more extensive scale is now, I think, timely. Certain unsolved questions relating to personal equation will also be advanced towards a solution by the speedy publication of the materials here collected.

The method of observation is the following.

At the beginning of an evening's work the time is determined, as well as the deviation of the instrument from the pole, Bessel's n, by stars from the Berlin Jahrbuch. These observations are followed by a set of observations of stars to be determined, and the evening's work concluded by other stars from the Berlin Jahrbuch. From the beginning I have taken pains that every determined star should be preceded and followed by enough standard stars to make the interpolation of the n perfectly certain, and to give the n a weight of at least two observations of the star to be determined. Latterly, as the precision of the observations has become greater, I have taken similar pains with the clock corrections; so that now the framework of a good evening's observation is the following: —

$\begin{cases}\text{2–3 standard polars.}\\ \text{2 " time stars.}\end{cases}$
Stars to be determined.
$\begin{cases}\text{2–3 standard polars.}\\ \text{2 time stars.}\end{cases}$

It sometimes happens, however, that a star to be determined is preceded by an observation upon five wires and followed by another upon five wires of a close standard polar, like Polaris or λ Ursæ Minoris.

In case the weather changes during the evening, I have considered it safe to employ a one-sided determination of *n* and of the clock correction whenever the mean of the transits of the two or three standard polars is within an hour of that of the star to be determined.

The standard polars used by preference are those of the Jahrbuch within 10° of the pole; those between 5° and 10° receive three-fourths weight. When it is necessary to go beyond 10°, stars between 10° and 20° receive one-half weight. Such stars of the Jahrbuch as are given in the following catalogue are beyond 10°, and the observations here given have in no case been employed to determine the polar deviation.

The collimation has been determined by combination of level and nadir, or, latterly, by two collimators; one of these has an aperture of 2½ inches, and is an ordinary telescope with tube, pivots, level, and micrometer; the other is composed of a long-focus object-glass of five inches aperture and a temporary meridian mark, to be later replaced by a permanent apparatus, provided by the makers, but not yet mounted.

In the use of the catalogue of the Jahrbuch the only point to be especially noted is, that polar stars whose places are relatively uncertain have been, so far as possible, avoided. Their uncertainty has been pointed out by Professor Auwers, the author of the catalogue; and is mainly owing to proper motion. The best stars are those which were observed by Bradley twice or more. One pair of stars (76 Draconis above pole, and Draconis 1 H. below, or *vice versa*) gave values of *n* differing systematically from each other by over $0^s.1$; but it so happened that the mean correction, derived from later observations of both, combined with a new investigation of their proper motions, was almost exactly zero; so that I made it a rule to observe the pair together, leaving the more refined investigation of the necessary corrections to a later date. At first I employed the standard polars between 10° and 20° polar distance more freely than later.

Whenever stars beyond 10° of the pole were employed to determine *n* they received a weight of one half, and those between 5° and 10° a weight of three fourths; those within 5° (of which the Jahrbuch gives daily ephemerides) represented the unit of weight; the probable error of an *n* corresponding to this unit has been, in the mean, not far from $\pm 0^s.020$. This probable error, however, does not include the whole of the errors in the Jahrbuch places, but is somewhat greater than would be given by perfect standard right ascensions reduced to my method of observing. Omitting those stars beyond 10° of polar distance, for which I have no great number of observations, and eliminating errors of star places and personal equation, but making no distinction between observations in different positions of the instrument, I obtain $\pm 0^s.018$ for the probable error of a transit, weight $= 1$. This includes a fair average of the earlier, less precise observations.

In the tables which follow are given the separate results for each night, as they were derived from the immediate reduction. The calculations were not, strictly speaking, duplicated; but a course was pursued which left very little chance of error. The first thing to be noted is, that only those stars were reduced which have been four or more times observed between July, 1882, and December, 1883. It is intended to observe each star's right ascension eight times, in two different positions; and to double or quadruple this number for the more important polars.

All stars within 10° of the pole brighter than the magnitude 7.5 (Durchmusterung), all in the same region which are fainter but important from proper motion, and all others, wherever situated, which I can find to have been anywhere used as standard northern polars, are included in the working list. Each such star might be observed in eight positions, as the instrument is reversible, and its object-glass and eyepiece interchangeable, if we included observations below the pole. Two of these positions, four observations in each, will suffice for the majority of stars; four positions, for the stars of Professor Albrecht's catalogue, prepared for the European geodetic association; while the eight positions, or 32 observations, will be adopted for stars within 10° of polar distance whose places are given in the ephemerides. The more important standard polars of the Jahrbuch will not be definitively determined until the mark is permanently set up: at present their observations furnish only values of n and equations of condition (not here given) among the various stars.

The instrument was not reversed during the present series, but the eye-piece and object-glass were interchanged, September 4, 1883. Before that date the observations were not so accurate as afterwards, owing to various small causes of error. The instrument was liable to slight strains, until the counterpoises were properly regulated; this affects the observations up to April 17, 1883. There was a month's interruption after this date, due to illness. The collimation was a little uncertain during the winter; the assistant who determined it by level and nadir met with some difficulty in levelling, and his results were not very accordant. The clock was frequently inaudible; much of the time an assistant gave me the ticks during transits, and relief was finally obtained by a galvanic connection with a telegraphic sounder. This took place in or about July, 1883. The exchange of object-glass and eyepiece put an end to a trouble with the field illumination, which was due seemingly to a displacement of the prisms in transportation.

Very few observations are made upon less than five wires; half-weight* is given to one or two wires; and in the case of the stars nearest the pole the movable vertical wire is freely used. As its coincidence with the fixed wire varies a little with the temperature, it is necessary to determine its coincidence with the central fixed wire very carefully. The reductions to mean place have been effected with the data of the American Ephemeris, — which agree closely with those of the Jahrbuch, — and have been duplicated in many cases, employing Bessel's two sets of formulæ. As declinations have not been observed, they have been pretty carefully computed from modern catalogues, so that their values as employed are usually correct to $1''$.

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* More frequently the half-weight is due to a combination of unfavorable circumstances noted at the time of observation, or in one case to large and irregular changes in the instrumental correction, so that its true value was uncertain. One observation has been rejected for this reason; but may perhaps prove reducible later.

MEAN RIGHT ASCENSIONS FOR 1883.0.

Results of Separate Observations.

BRADLEY 48.

	h. m.	s.
1883, Nov. 7	0 30	59.33
16		58.90
27		59.14
Dec. 6		59.12
Mean A. R. 1883.0	0 30	59.122

BRADLEY 74.

	h. m.	s.
1883, May 17 s. p.	0 44	0.46
June 1 s. p.		0.21
Nov. 16		0.54
27		0.63
Dec. 6		0.49
15		0.64
Mean A. R. 1883.0	0 44	0.495

BRADLEY 65.

	h. m.	s.
1883, May 29 s. p.	0 51	29.87
June 1 s. p.		29.42
Nov. 7		28.08
27		27.34
Dec. 6		27.74
15		27.49
Mean A. R. 1883.0	0 51	28.323

BRADLEY 95.

	h. m.	s.
1883, May 25 s. p.	0 56	37.95
29 s. p.		39.00
June 1 s. p.		38.49
8 s. p.		38.12
Mean A. R. 1883.0	0 56	38.390

38 CASSIOPEIÆ A. E.

		s.
1882, Dec. 8		+0.33
12 [wt. = ½]		+0.69
15		+0.14
1883, Jan. 15		0.00
		+0.233
A. E.		32.314
	h. m.	s.
Mean A. R. 1883.0	1 22	32.547

GROOMBRIDGE 339.

	h. m.	s.
1883, June 5 s. p.	1 36	55.32
8 s. p.		54.63
12 s. p.		55.57
14 s. p.		54.19
Mean A. R. 1883.0	1 36	54.928

SCHWERD 75.

	h. m.	s.
1883, June 5 s. p.	1 44	1.42
8 s. p.		1.79
12 s. p.		2.57
14 s. p.		2.46
Mean A. R. 1883.0	1 44	2.060

GROOMBRIDGE 424.

	h. m.	s.
1882, Dec. 8	1 55	5.12
15		4.61
1883, June 9 s. p.		4.93
14 s. p.		5 02
15 s. p.		4.88
Mean A. R. 1883.0	1 55	4.912

BRADLEY 344.

	h. m.	s.
1882, Dec. 12 [wt. = ½]	2 31	1.25
15	30	59.98
1883, Feb. 7	31	0.75
8		0.64
June 14 s. p.		0.44
22 s. p.		0.04
23 s. p.		0.20
25 s. p.		0.07
Mean A. R. 1883.0	2 31	0.366

GROOMBRIDGE 642.*

	h. m.	s.
1882, July 20 s. p	3 28	20.25
1883, Jan. 18		20.45
Feb. 5		19.57
7		20.26
8		19.86
June 22 s. p.		20.18
25 s. p.		19.69
July 10 s. p.		19.37
Mean A. R. 1883.0	3 28	19.954

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* In reducing these observations to 1883.0, a yearly proper motion of $+0^s.164$ was employed.

MEAN RIGHT ASCENSIONS FOR 1883.0. — *Continued.*

Groombridge 766.

	h.	m.	s.
1883, July 18 s. p.	4	1	12.03
19 s. p.			12.00
20 s. p.			12.19
23 s. p.			11.97
Mean A. R. 1883.0	4	1	12.048

Groombridge 774.

	h.	m.	s.
1883, July 20 s. p.	4	4	22.50
23 s. p.			22.75
24 s. p.			22.93
25 s. p.			23.03
Mean A. R. 1883.0	4	4	22.802

Groombridge 779.

	h.	m.	s.
1882, July 22 s. p.	4	6	45.04
24 s. p.			44.90
25 s. p.			44.59
1883, Jan. 18			44.59
23			44.75
July 10 s. p.			44.34
14 s. p.			44.28
Mean A. R. 1883.0	4	6	44.641

Groombridge 785.

	h.	m.	s.
1883, Jan. 23	4	9	4.65
31			4.61
July 11 s. p.			4.78
14 s. p.			4.21
16 s. p.			4.65
18 s. p.			5.09
Mean A. R. 1883.0	4	9	4.665

Schwerd 242.

	h.	m.	s.
1883, Jan. 18	4	16	12.91
23			12.85
31			12.85
July 11 s. p.			12.55
14 s. p.			12.62
16 s. p.			12.54
18 s. p.			12.71
Mean A. R. 1883.0	4	16	12.719

Schwerd 241.

	h.	m.	s.
1883, July 10 s. p.	4	17	30.10
11 s. p.			29.54
14 s. p.			29.55
16 s. p.			29.67
Mean A. R. 1883.0	4	17	29.715

Piazzi IV. 59.

	h.	m.	s.
1883, Jan. 18	4	25	36.13
23			36.19
31			36.52
Feb. 23			36.27
July 11 s. p.			35.86
14 s. p.			36.05
16 s. p.			35.89
18 s. p.			36.20
Mean A. R. 1883.0	4	25	36.139

Piazzi IV. 77.

	h.	m.	s.
1883, Jan. 18	4	28	36.83
23			37.01
31			37.17
Feb. 23			37.07
July 11 s. p.			37.17
14 s. p.			37.12
16 s. p.			36.76
18 s. p.			37.04
Mean A. R. 1883.0	4	28	37.021

Groombridge 848.

		h.	m.	s.
1883, July 18 s. p.	B. J.			+0.15
20 s. p.				+0.11
23 s. p.				—0.21
26 s. p.				—0.38
30 s. p.				—0.17
	Mean			—0.100
	B. J.			6.616
Mean A. R. 1883.0		4	33	6.516

Cephei 50 H.

	h.	m.	s.
1882, July 24 s. p.	4	38	30.07
25 s. p.			30.40
1883, Jan. 18			30.16
23			30.12
31			30.26
Feb. 23			30.06
July 11 s. p.			30.07
14 s. p.			30.65
Mean A. R. 1883.0	4	38	30.224

MEAN RIGHT ASCENSIONS FOR 1883.0. — *Continued.*

RADCLIFFE 1311.

	h. m.	s.
1882, July 24 s. p.	4 50	27.70
25 s. p.		28.23
1883, Jan. 31		27.27
Feb. 23		27.84
July 20 s. p.		26.91
23 s. p.		27.65
Mean A. R. 1883.0	4 50	27.600

CAMELOPARDALI 19 H.

		s.
1882, July 30 s. p.	B. J.	+0.23
Aug. 3 s. p.		+0.23
4 s. p.		+0.21
6 s. p.		+0.25
8 s. p.		+0.17
9 s. p.		+0.23
11 s. p.		+0.38
21 s. p.		+0.08
22 s. p.		+0.10
	Mean	+0.209
	B. J.	17.735
	h. m.	s.
Mean A. R. 1883.0	5 3	17.944

RADCLIFFE 1377.

	h. m.	s.
1882, July 21 s. p.	5 4	14.35
24 s. p.		14.11
1883, Jan. 31		13.85
July 20 s. p.		13.65
23 s. p.		13.71
Mean A. R. 1883.0	5 4	13.934

SCHWERD 306.

	h. m.	s.
1883, July 20 s. p.	5 7	32.77
24 s. p.		32.71
30 s. p.		32.99
31 s. p.		32.70
Mean A. R. 1883.0	5 7	32.792

GROOMBRIDGE 966.

		s.
1883, July 23 s. p.	B. J.	—0.04
24 s. p.		—0.25
Aug. 6 s. p.		—0.11
9 s. p.		—0.34
11 s. p.		—0.06
14 s. p.		—0.31
	Mean	—0.185
	B. J.	5.196
	h. m.	s.
Mean A. R. 1883.0	5 24	5.011

GROOMBRIDGE 944.

		s.
1882, July 20 s.p.	A.E.(Suppl.)	+0.37
21 s.p.		+0.21
1883, Feb. 13		—0.72
Mar. 5		+0.08
July 20 s. p.		—0.44
23 s. p.		—0.22
	Mean	—0.120
	A.E.(Suppl.)	37 900
	h. m.	s.
Mean A. R. 1883.0	5 24	37.780

GROOMBRIDGE 1004.

	h. m.	s.
1882, July 20 s. p.	6 0	29.58
21 s. p.		30.17
1883, Feb. 8		28.85
13		28.12
Mar. 1		29.33
5		29.38
July 30 s. p.		28.81
Aug. 3 s. p.		28.50
Mean A. R. 1883.0	6 0	29.092

SCHWERD 362.

	h. m.	s.
1883, Mar. 8	6 13	48.09
22		47.87
Aug. 3 s. p.		47.61
4 s. p.		47.69
8 s. p.		47.22
9 s. p.		47.71
Mean A. R. 1883.0	6 13	47.698

SCHWERD 369.

	h. m.	s.
1883, Feb. 13	6 19	44.84
Mar. 1		45.51
8		45.78
22		45.45
July 30 s. p.		45.53
Aug. 3 s. p.		45.30
4 s. p.		45.35
6 s. p.		45.55
Mean A. R. 1883.0	6 19	45.414

SCHWERD 377.

	h. m.	s.
1883, July 30 s. p.	6 25	58.20
Aug. 3 s. p.		57.82
4 s. p.		58.10
6 s. p.		57.94
Mean A. R. 1883.0	6 25	58.015

MEAN RIGHT ASCENSIONS FOR 1883.0. — *Continued.*

CAMELOPARDALI 23 H.

		h.	m.	s.
1883, Sept. 6	B. J.			+0.22
15				—0.20
17				+0.12
18				—0.24
19				+0.02
Oct. 3				+0.42
	Mean			+0.057
	B. J.			14.649
Mean A. R. 1883.0		6	26	14.706

CAMELOPARDALI 24 H.

		h.	m.	s.
1883, Sept. 15	B. J.			—0.01
17 [wt. = ½]				+0.50
18				—0.24
Oct. 1				+0.45
3				+0.16
5				—0.01
	Mean			+0.109
	B. J.			59.109
Mean A. R. 1883.0		6	42	59.218

GROOMBRIDGE 1255.

	h.	m.	s.
1883, Feb. 23	7	3	7.02
Mar. 1			7.00
8			6.82
13			7.12
Sept. 18 s. p.			6.79
19 s. p.			6.80
Oct. 1 s. p.			6.85
3 s. p.			6.82
Mean A. R. 1883.0	7	3	6.902

CAMELOPARDALI 25 H.

		h.	m.	s.
1882, Sept. 9 s. p.	A. E. Suppl.			—0.34
12 s. p.				—0.88
15 s. p. [wt. = ½]				—0.03
16 s. p.				—0.64
Oct. 10 s. p.				—0.60
1883, Feb. 7				—0.46
23				—0.26
Mar. 1				—0.34
8				+0.10
Sept. 5 s. p.				—0.60
6 s. p.				—0.41
17 s. p.				—0.18
18 s. p.				—0.52
19 s. p.				—0.82
	Mean			—0.442
	A. E.			23.837
Mean A. R. 1883.0		7	6	23.395

SCHWERD 406.

	h.	m.	s.
1883, Mar. 1	7	9	11.25
8			10.37
13			10.79
16			10.12
21			10.20
Mean A. R. 1883.0	7	9	10.546

SCHWERD 415.

	h.	m.	s.
1883, Feb. 23	7	11	25.69
Mar. 1			26.15
13			25.71
16			25.64
21			25.34
Mean A. R. 1883.0	7	11	25.706

GROOMBRIDGE 1278.

	h.	m.	s.
1883, Aug. 8 s. p.	7	13	17.85
Sept. 5 s. p.			17.33
6 s. p.			17.50
17 s. p.			17.64
19 s. p.			17.70
Mean A. R. 1883.0	7	13	17.604

SCHWERD 424.

	h.	m.	s.
1883, Mar. 1	7	22	2.61
8			2.50
13			2.60
16			2.32
21			2.24
Sept. 19 s. p.			2.44
26 s. p.			2.52
Oct. 1 s. p.			2.32
3 s. p.			2.41
Mean A. R. 1883.0	7	22	2.440

CAMELOPARDALI 28 H.

	h.	m.	s.
1882, Oct. 21	7	36	52.84
26 s. p.			53.76
30 s. p.			53.10
1883, Mar. 13			53.06
16			52.83
29			52.86
April 6			53.22
Sept. 19 s. p.			52.76
22 s. p.			52.50
26 s. p.			53.15
Oct. 1 s. p.			52.72
3 s. p.			52.81
Mean A. R. 1883.0	7	36	52.968

MEAN RIGHT ASCENSIONS FOR 1883.0. — *Continued.*

GROOMBRIDGE 1119.

		s.
1882, Sept. 9 s. p.	C. des T.	+5.43
12 s. p.		8.00
15 s. p.		7.82
16 s. p.		6.48
1883, Feb. 7		4.91
19		8.62
23		9.03
Mar. 1		5.69
Sept. 5 s. p.		5.10
6 s. p.		6.98
15 s. p.		2.71
18 s. p.		3.09
	Mean	+6.155
	C. des T.	37.86
	h. m.	s.
Mean A. R. 1883.0	7 38	44.015

GROOMBRIDGE 1355.

	h. m.	s.
1883, Sept. 21 s. p.	7 40	30.27
22 s. p.		30.14
26 s. p.		30.34
Oct. 1 s. p.		30.25
Mean A. R. 1883.0	7 40	30.250

GROOMBRIDGE 1368.

	h. m.	s.
1883, Feb. 23	7 46	20.13
Mar. 13		20.55
16		20.23
23		19.69
24		20.22
Sept. 22 s. p.		20.10
Oct. 1 s. p.		20.10
5 s. p.		20.12
9 s. p.		20.00
Mean A. R. 1883.0	7 46	20.127

RADCLIFFE 2020.

	h. m.	s.
1883, Mar. 13	7 46	45.88
24		45.24
29		45.27
April 6		46.46
Oct. 15 s. p.		45.44
22 s. p.		45.29
Mean A. R. 1883.0	7 46	45.597

GROOMBRIDGE 1359.

	h. m.	s.
1882, Sept. 16 s. p.	7 48	46.02
Oct. 28. s. p.		45.96
30 s. p.		45.88
31 s. p. [wt. $= \frac{1}{2}$]		45.32
1883, Mar. 16		45.84
21 [wt. $= \frac{1}{2}$]		45.02
23		45.30
24		45.69
28		46.02
Sept. 22 s. p.		46.56
Oct. 5 s. p.		45.97
9 s. p.		45.53
11 s. p.		46.00
Mean A. R. 1883.0	7 48	45.828

GROOMBRIDGE 1391.

	h. m.	s.
1882, Oct. 28 s. p.	8 1	46.91
30 s. p.		46.75
Nov. 10 s. p.		46.79
1883, Mar. 13		47.22
16		46.54
23		46.50
24		46.64
28		47.23
Oct. 1 s. p.		46.84
5 s. p.		47.25
22 s. p.		46.82
Mean A. R. 1883.0	8 1	46.863

GROOMBRIDGE 1418.

	h. m.	s.
1882, Sept. 16 s. p.	8 20	38.68
Oct. 7 s. p.		38.87
26 s. p.		39.36
28 s. p.		38.83
1883, Mar. 13		39.79
21		38.20
23		38.73
28		39.62
Mean A. R. 1883.0	8 20	39.010

GROOMBRIDGE 1431.

	h. m.	s.
1883, Mar. 21	8 25	6.61
23		6.48
29		6.90
April 2		6.95
Sept. 15 s. p.		6.60
Oct. 3 s. p.		6.74
5 s. p.		7.01
22 s. p.		6.96
Mean A. R. 1883.0	8 25	6.781

MEAN RIGHT ASCENSIONS FOR 1883.0.— *Continued.*

SCHWERD 529.

	h.	m.	s.
1882, Nov. 10 s. p.	8	38	31.88
15 s. p.			31.42
16 s. p.			31.78
18 s. p.			31.64
1883, April 2			31.44
6			31.81
9			32.12
10			31.92
Mean A. R. 1883.0	8	38	31.751

SCHWERD 533.

	h.	m.	s.
1882, Oct. 30 s. p.	8	41	15.51
Nov. 4 s. p.			15.31
6 s. p.			15.99
8 s. p.			16.05
1883, Mar. 23			15.83
24			15.80
29			16.18
April 2			15.89
Mean A. R. 1883.0	8	41	15.820

RADCLIFFE 2218.

	h.	m.	s.
1882, Oct. 7 s. p.	8	50	43.89
13 s. p.			44.22
14 s. p.			43.48
Nov. 6 s. p.			43.90
8 s. p.			44.00
1883, Mar. 29			44.10
April 2			44.24
6			44.77
9			44.21
Mean A. R. 1883.0	8	50	44.090

GROOMBRIDGE 1480.

	h.	m.	s.
1883, April 10	8	53	38.52
13			38.57
14			39.25
17			38.72
Mean A. R. 1883.0	8	53	38.765

SCHWERD 587.

	h.	m.	s.
1833, April 2	9	44	41.06
14			41.77
17			40.80
Oct. 17 s p.			41.12
Nov. 27 s. p.			41.40
29 s. p.			41.52
Mean A. R. 1883.0	9	44	41.278

RADCLIFFE 2404.

	h.	m.	s.
1883, Mar. 20	9	49	40.82
22			39.82
April 2			40.19
10			40.32
Oct. 17 s. p.			40.64
Nov. 27 s. p.			39.76
28 s. p.			40.86
29 s. p.			40.47
Mean A. R. 1883.0	9	49	40.360

RADCLIFFE 2407.

	h.	m.	s.
1883, Mar. 20	9	58	13.82[*]
April 2			11.63
17			11.83
Oct. 17 s. p.			13.55
Mean A. R. 1883.0	9	58	12.708

CAMELOPARDALI 29 H.

	h.	m.	s.
1882, Oct. 13 s. p.	10	12	28.12[†]
Dec. 9 s. p.			26.46
12 s. p.			26.76
1883, Mar. 20			27.34
22			26.47
April 14			26.99
17			27.07
Oct. 17 s. p.			27.08
Nov. 27 s. p.			26.29
28 s. p.			27.01
Dec. 3 s. p.			26.86
6 s. p.			26.26
Mean A. R. 1883.0	10	12	26.892

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[*] This star, a close polar, was observed with the micrometer: and for this date the micrometrical zero-point is apparently ill-determined

[†] This observation is discrepant, probably owing to a change in the position of the instrument; but the seeing was also very bad, and I have retained it unchanged for uniformity's sake, leaving any correction to a final discussion of a few suspected evenings. As soon as nearly final right-ascensions of all the stars observed on this date shall be ready, it will be possible to follow the changes in the value of n from $18^h.8$ to $22^h.3$ sidereal time, and decide whether the discrepancies in this quantity are accidental or progressive; at present Cephei 51 H. s p gives $n + c = +1^s.949$; Camelopardali 30 H. s. p. $+2^s.113$. I had attributed the difference to the wretched seeing in assigning the mean, and so reduced all the observations.

MEAN RIGHT ASCENSIONS FOR 1883.0.— *Continued.*

RADCLIFFE 2594.

	h.	m.	s.
1882, Oct. 28 s. p.	11	0	19.59
Nov. 4 s. p.			18.31
10 s. p.			16.08
16 s. p.			19.83
1883, Oct. 17 s. p.			18.00
Nov. 16 s. p.			17.23
Mean A. R. 1883.0	11	0	18.173

GROOMBRIDGE 1782.

	h.	m.	s.
1882, Oct. 20 s. p.	11	23	32.60
28 s. p.			32.89
Nov. 4 s. p.			32.17
10 s. p.			32.00
Mean A. R. 1883.0	11	23	32.415

GROOMBRIDGE 1850.

	h.	m.	s.
1882, Nov. 4 s. p.	11	58	51.34
10 s. p.			50.66
1883, Dec. 26 s. p.			50.61
29 s. p.			49.96
Mean A. R 1883.0	11	58	50.642

BRADLEY 1656.

	h.	m.	s.
1883, May 29	12	13	25.50
Oct. 15 s. p.			25.27
Nov. 7 s. p.			24.93
16 s. p.			25.05
Dec. 26 s. p.			25.53
Mean A. R. 1883.0	12	13	25.256

BRADLEY 1672.

				s.
1882, Nov. 10 s. p.	C. des T.			+0.77
18 s. p.				+2.41
21 s. p.				+2.17
1883, May 17				+2.68
18				+2.62
25				+2.98
28				+4.22
Oct. 15 s. p.				+2.06
Nov. 7 s. p.				+1.42
16 s. p.				+2.59
Dec. 26 s. p.				+2.02
	Mean			+2.358
	C. des T.			18.30
		h.	m.	s.
Mean A. R. 1883.0		12	14	20.658

GROOMBRIDGE 1923.

	h.	m.	s.
1882, Nov. 21 s. p.	12	37	32.54
1883, May 17			32.92
25			33.08
29			33.21
June 1			33.66
Nov. 27 s. p.			32.42
Mean A. R. 1883.0	12	37	32.972

GROOMBRIDGE 1927.

	h.	m.	s.
1883, May 17	12	41	27.79
25			27.67
29			27.60
June 1			28.50
Nov. 7 s. p.			27.70
Dec. 6 s. p.			27.61
29 s. p.			27.59
Mean A. R. 1883.0	12	41	27.780

CAMELOPARDALI 32 H. foll.

				s.
1882, Oct. 20 s. p.	A. E.			—0.20
Nov. 21 s. p.				—0.62
Dec. 9 s. p.				—0.02
1883, Jan. 11 s. p.	[wt. = ½]			—0.95
12 s. p.				—0.79
15 s. p.				—0.43
May 17				—0.10
18				—0.12
25				—0.65
28				—0.20
Oct. 15 s. p.				—0.50
Nov. 16 s. p.				—0.38
27 s. p.				—0.51
Dec. 6 s. p.				—0.64
	Mean			—0.417
	A. E.			16.753
		h.	m.	s.
Mean A. R. 1883.0		12	48	16.336

GROOMBRIDGE 2006.

	h.	m.	s.
1883, June 1	13	7	7.17
8			6.42
Nov. 16 s. p.			6.79
27 s. p.			6.70
28 s. p.			6.85
Dec. 6 s. p.			6.82
Mean A. R. 1883.0	13	7	6.792

MEAN RIGHT ASCENSIONS FOR 1883.0.— *Continued.*

Groombridge 2007.

	h.	m.	s.
1883, May 25	13	19	22.64
June 1			22.16
5			21.94
8			22.75
Nov. 27 s. p.			22.16
28 s. p.			22.41
Dec. 6 s. p.			21.75
15 s. p.			21.88
Mean A. R. 1883.0	13	19	22.211

Groombridge 2063.

	h.	m.	s.
1883, June 8	13	45	43.54
9			43.59
12			43.37
14			43.86
15			43.81
Mean A. R. 1883.0	13	45	43.634

Groombridge 2071.

	h.	m.	s.
1883, June 8	13	52	44.68
9			44.53
14			44.71
15			44.78
Mean A. R. 1883.0	13	52	44.675

Groombridge 2099.

	h.	m.	s.
1882, Dec. 8 s. p.	14	1	29.10
12 s. p.	[wt. = ½]		27.43
15 s. p.			30.08
1883, Jan. 22 s. p.			29.19
23 s. p.			28.40
June 5			28.36
12			28.26
14			27.78
15			28.53
Mean A. R. 1883.0	14	1	28.637

5 Ursæ Minoris.

		h.	m.	s.
1883, June 14	A. E.			+0.11
22				−0.07
23				+0.08
25				+0.14
	Mean			+0.065
	A. E.			47.155
Mean A. R. 1883.0		14	27	47.220

Groombridge 2196.

	h.	m.	s.
1883, Feb. 7 s. p.	14	58	18.17
8 s. p.			18.21
12 s. p.			17.91
June 22			18.02
23			18.33
25			18.28
July 10			18.29
Mean A. R. 1883.0	14	58	18.173

Groombridge 2213.

	h.	m.	s.
1883, Feb. 7 s. p.	15	3	33.89
8 s. p.			33.97
June 23			34.08
July 11			33.46
Mean A. R. 1883.0	15	3	33.850

Groombridge 2283.

		h.	m.	s.
1883, Jan. 18 s. p.	C. des T.			−2.75
Feb. 5 s. p.				−1.37
7 s. p.				−2.16
8 s. p.				−1.88
June 14				−2.63
15				−1.55
22				−2.70
July 10				−2.68
	Mean			−2.215
	C. des T.			22.18
Mean A. R. 1883.0		15	15	19.965

11 Ursæ Minoris.

	h.	m.	s.
1883, June 14	15	17	11.67
22			11.90
July 11			11.66
14			12.04
Mean A. R. 1883.0	15	17	11.818

Groombridge 2275.

	h.	m.	s.
1883, Jan. 18 s. p.	15	36	1.22
Feb. 12 s. p.			1.08
June 25			1.59
July 11			1.45
14			1.74
16			1.92
Mean A. R. 1883.0	15	36	1.500

MEAN RIGHT ASCENSIONS FOR 1883.0. — *Continued.*

GROOMBRIDGE 2276.

	h.	m.	s.
1883, Jan. 18 s. p.	15	36	13.92
Feb. 12 s. p.			13.64
June 25			14.18
July 11			14.28
14			14.44
16			14.49
Mean A. R. 1883.0	15	36	14.158

RADCLIFFE 3445.

	h.	m.	s.
1883, June 22	15	37	3.09
July 10			2.94
11			2.77
14			2.93
Mean A. R. 1883.0	15	37	2.932

SCHWERD 932.

	h.	m.	s.
1883, July 10	15	44	2.42
11			2.50
14			3.00
16			2.79
Mean A. R. 1883.0	15	44	2.678

RADCLIFFE 3475.

	h.	m.	s.
1883, July 10	15	45	22.48
14			23.12
16			22.40
18			23.21
Mean A. R. 1883.0	15	45	22.802

18 URSÆ MINORIS.

	h.	m.	s.
1883, Feb. 19 s. p.	15	46	6.29
July 11			5.82
14			6.12
16			6.13
18			6.01
Mean A. R. 1883.0	15	46	6.074

SCHWERD 945.

	h.	m.	s.
1883, July 14	15	52	36.38
16			36.07
18			36.65
20			37.08
Mean A. R. 1883.0	15	52	36.545

GROOMBRIDGE 2315.

	h.	m.	s.
1883, Jan. 18 s. p.	15	55	38.98
23 s. p.			38.56
Feb. 12 s. p.			39.25
19 s. p.			39.25
June 22			38.76
July 11			39.17
14			39.56
16			38.43
Mean A. R. 1883.0	15	55	38.995

A DRACONIS.

		h.	m.	s.
1883, July 19	B. J.			+0.26
20				+0.26
23				+0.17
24				+0.20
30				+0.26
	Mean			+0.230
	B. J.			12.884
Mean A. R. 1883.0		16	28	13.114

SCHWERD 988.

	h.	m.	s.
1883, July 10	16	36	4.19
11			3.96
14			4.30
16			3.86
Mean A. R. 1883.0	16	36	4.078

SCHWERD 986.

	h.	m.	s.
1883, July 16	16	38	52.97
18			52.95
19			53.34
20			53.27
Mean A. R. 1883.0	16	38	53.132

SCHWERD 1016.

	h.	m.	s.
1883, July 24	17	6	13.47
30			13.59
31			13.37
Aug. 3			13.72
Mean A. R. 1883.0	17	6	13.538

GROOMBRIDGE 2456.

	h.	m.	s.
1883, Feb. 13 s. p.	17	28	29.43
Mar. 5 s. p.			30.15
July 20			30.06
24			29.90
26			30.06
30			29.77
Mean A. R. 1883.0	17	28	29.895

MEAN RIGHT ASCENSIONS FOR 1883.0. — *Continued.*

GROOMBRIDGE 2476.

		h.	m.	s.
1883, Feb. 13	s. p.	17	35	2.57
Mar. 1	s. p.			2.50
5	s. p.			2.34
Aug. 14				2.63
21				2.51
22				2.50
Mean A. R. 1883.0		17	35	2.508

ψ DRACONIS (SOUTHERN STAR).

				s.
1883, July 23	B. J.			+0.24
24				+0.11
Aug. 3				+0.20
4				+0.31
6				+0.21
8				+0.30
11				+0.30
	Mean			+0.239
	B. J.			1.223
		h.	m.	s.
Mean A. R. 1883.0		17	44	1.462

SCHWERD 1059.

	h.	m.	s
1883, July 30	17	51	26.31
Aug. 3			26.23
4			26.34
6			26.25
Mean A. R. 1883.0	17	51	26.282

35 DRACONIS.

				s.
1883, Aug. 4	B. J.			+0.02
6				+0.11
9				+0.04
11				+0.14
14				+0.01
21				+0.12
22				+0.05
	Mean			+0.070
	B. J.			41.285
		h.	m.	s.
Mean A. R. 1883.0		17	54	41.355

40 DRACONIS.

	h.	m.	s.
1883, Aug. 6	18	8	47.60
8			47.81
9			47.67
11			47.66
Mean A. R. 1883.0	18	8	47.685

41 DRACONIS.

	h	m.	s.
1883, Aug. 6	18	8	53.78
8			54.04
9			53.98
11			54.06
Sept. 6			53.79
19			53.70
Mean A. R. 1883.0	18	8	53.892

24 URSÆ MINORIS.

		h.	m.	s.
1883, Feb. 8	s. p.	18	14	6.93
13	s. p.			5.94
27	s. p.			6.62
Mar. 1	s. p.			5.80
July 30				5.93
Aug. 3				6.11
4				6.07
6				5.47
Sept. 6				6.55
15				6.62
18				6.58
19				5.23
Mean A. R. 1883.0		18	14	6.154

χ DRACONIS.

				s.
1883, Aug. 14	B. J.			+0.19
Sept. 6				+0.07
15				+0.14
17	[wt. = ½]			+0.33
18				−0.28
19				−0.10
Oct. 3				+0.02
5				−0.21
9				−0.19
10				−0.09
13				−0.02
15				+0.03
17				−0.15
	Mean			−0.034
	B. J.			9.902
		h.	m.	s.
Mean A. R. 1883.0		18	23	9.868

RADCLIFFE 3961.

		h.	m.	s.
1883, Feb. 13	s. p.	18	24	3.72
Mar. 1	s. p.			3.70
8	s. p.			3.95
22	s. p.			3.72
July 30				4.03
Aug. 3				3.83
4				4.18
6				4.08
Mean A. R. 1883.0		18	24	3.901

MEAN RIGHT ASCENSIONS FOR 1883.0. — *Continued.*

BRADLEY 2412.

	h. m.	s.
1882, July 20	18 39	34.30
Sept. 9		34.78
12		34.81
1883, Mar. 1 s. p.		34.86
8 s. p.		34.52
13 s. p.		34.70
22 s. p.		34.21
Sept. 6		34.59
15		34.56
17		34.59
18		34.69
19		34.59
Mean A. R. 1883.0	18 39	34.600

50 DRACONIS.

		s.
1883, Sept. 15	A. E.	+0.07
18		+0.01
19		+0.14
Oct. 3		+0.28
	Mean	+0.125
	A. E.	8.402
	h. m.	s.
Mean A. R. 1883.0	18 50	8.527

RADCLIFFE 4208.

	h. m.	s.
1882, Sept. 9	18 53	1.97
12		1.98
16		2.42
1883, Mar. 16 s. p.		2.53
Aug. 8		1.47
Mean A. R. 1883.0	18 53	2.074

υ DRACONIS.

		s.
1883, Oct. 9	B. J.*	—0.16
11		—0.10
15		—0.07
16		+0.11
17		+0.12
18		—0.10
	Mean	—0.033
	B. J.	49.662
	h. m.	s.
Mean A. R. 1883.0	18 55	49.629

RADCLIFFE 4253.

	h. m.	s.
1883, Sept. 18	19 6	27.89
Oct. 1		28.63
3		28.07
5		27.81
Mean A. R. 1883.0	19 6	28.100

RADCLIFFE 4300.

	h. m.	s.
1883, Aug. 8	19 15	39.05
11		38.95
Sept. 6		38.90
18		39.10
Oct. 1		38.79
3		38.65
Mean A. R. 1883.0	19 15	38.907

RADCLIFFE 4313.

	h. m.	s.
1883, Aug. 8	19 16	48.50
11		48.96
Sept. 6		48.31
18		48.34
19		48.36
26		48.73
Mean A. R. 1883.0	19 16	48.533

τ DRACONIS.

		s.
1883, Oct. 5	B. J.	—0.32
9		—0.18
10		—0.08
11		—0.24
16		+0.01
	Mean	—0.162
	B. J.	47.807
	h. m.	s.
Mean A. R. 1883.0	19 17	47.645

GROOMBRIDGE 2900.

		s.
1883, Sept. 26	B. J.*	+0.18
27		+0.43
Oct. 1		—0.21
3		+0.20
9		+0.17
10		+0.40
11		+0.01
22		+0.33
	Mean	+0.189
		44.832
	h. m.	s.
Mean A. R. 1883.0	19 28	45.021

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* An ephemeris was computed from the data in the Jahrbuch.

MEAN RIGHT ASCENSIONS FOR 1883.0. — *Continued.*

SCHWERD 1172.

		h.	m.	s.
1882, Oct. 21		19	30	2.72
26				1.99
1883, Mar. 1	s. p.			2.81
8	s. p.			3.05
13	s. p.			2.48
16	s. p.			2.69
21	s. p.			3.47
Sept. 5				2.46
6				2.43
19				2.33
21				2.73
Mean A. R. 1883.0		19	30	2.651

κ CEPHEI.

		s.
1883, Sept. 19	B. J.	+0.21
22		+0.34
Oct. 1		—0.22
3		+0.22
5		—0.11
22		—0.19
	Mean	+0.042
	B. J.	48.394
	h. m.	s.
Mean A. R. 1883.0	20 12	48.436

GROOMBRIDGE 3402.

		h.	m.	s.
1883, Mar. 13	s. p.	20	13	25.95
21	s. p.			27.78
29	s. p.			24.70
Apr. 2	s. p.			26.36
Sept. 15				27.35
Oct. 1				27.60
3				28.45
5				25.99
Mean A. R. 1883.0		20	13	26.772

GROOMBRIDGE 3212.

		h.	m.	s.
1882, Oct. 7		20	16	18.57
30				18.20
31				18.42
Nov. 4				18.60
8				17.68
1883, Mar. 13	s. p.			17.97
23	s. p.			18.68
24	s. p.			18.92
28	s. p.			18.13
Sept. 15				18.44
19				18.24
22				18.33
Oct. 1				17.58
Mean A. R. 1883.0		20	16	18.289

SCHWERD 1213.

		h.	m.	s.
1882, Oct. 30		20	21	4.36
31				4.17
Nov. 4				4.05
6				4.41
8				4.03
1883, Mar. 23	s. p.			4.23
24	s. p.			4.56
29	s. p.			4.07
Apr. 2	s. p.			4.19
Mean A. R. 1883.0		20	21	4.230

GROOMBRIDGE 3260.

		h.	m.	s.
1882, Nov. 4		20	26	35.23
10				35.62
1883, Mar. 23	s. p.			35.52
24	s. p.			35.94
29	s. p.			35.17
Apr. 2	s. p.			35.21
Sept. 19				35.39
22				35.46
Oct. 1				35.16
3				35.47
Mean A. R. 1883.0		20	26	35.417

GROOMBRIDGE 3261.

		h.	m.	s.
1883, Apr. 9	s. p.	20	30	0.79
10	s. p.			0.07
13	s. p.			0.24
14	s. p.		29	59.89
Oct. 3				0.31
5				0.33
22				0.49
Mean A. R. 1883.0		20	30	0.303

BRADLEY 2673.

		s.
1882, Sept. 15	A. E.	—0.09
16		+0.03
Oct. 7		+0.12
13		+0.14
1883, Sept. 15		+0.07
19		+0.25
22		+0.22
Oct. 1		+0.10
	Mean	+0.105
	A. E.	30.186
	h. m.	s.
Mean A. R. 1883.0	20 30	30.291

MEAN RIGHT ASCENSIONS FOR 1883.0. — *Continued.*

Bradley 2701.

	h.	m.	s.
1882, Oct. 14	20	34	10.06
30			9.93
Nov. 4			9.73
6			9.68
1883, Mar. 13 s. p.			9.81
21 s. p.			10.08
23 s. p.			9.98
24 s. p.			10.44
Sept. 15			9.79
19			10.01
22			10.29
Oct. 1			9.60
Mean A. R. 1883.0	20	34	9.950

75 Draconis.

	h.	m	s.
1882, Oct. 13	20	35	31.85
30			31.45
Nov. 4			31.26
6			31.40
1883, Mar. 13 s. p.			31.44
21 s. p.			31.82
23 s. p.			31.73
24 s. p.			32.38
Mean A. R. 1883.0	20	35	31.666

Schwerd 1235

	h.	m	s.
1883, Apr. 13 s. p.	20	35	51.35
14 s. p.			51.11
Oct. 3			51.56
5			51.25
22			51.55
Mean A. R. 1883.0	20	35	51.364

74 Draconis.

	h.	m.	s.
1882, Sept. 15	20	36	10.29
16			10.79
Oct. 4			10.69
7			10.53
1883, Mar. 28 s. p.			10.47
29 s. p.			10.30
Apr. 2 s. p.			10.08
9 s. p.			10.65
Mean A. R. 1883.0	20	36	10.475

Radcliffe 4976.

	h.	m.	s.
1882, Oct. 4	20	40	39.63
7			39.59
13			39.90
14			39.82
1883, Mar. 28 s. p.			39.82
Apr. 6 s. p.			40.17
9 s. p.			40.53
10 s. p.			39.77
Mean A. R. 1883.0	20	40	39.904

Schwerd 1255.

	h.	m.	s.
1883, Nov. 7	21	0	26.91
8			26.97
16			26.94
17			26.95
19			27.02
Mean A. R. 1883.0	21	0	26.958

Schwerd 1258.

	h	m	s.
1883, Mar 22 s. p.	21	8	48.71
Apr. 2 s. p.			48.49
13 s. p.			48.63
14 s. p.			48.47
Oct. 18			48.75
Mean A. R. 1883.0	21	8	48.610

Schwerd 1260.

	h.	m.	s.
1883, Mar. 22 s. p.	21	11	44.43
Apr 2 s. p.			44.19
10 s. p.			44.90
13 s. p.			44.21
Nov. 5			44.21
7			44.18
8			44.34
16			44.18
Mean A. R. 1883.0	21	11	44.330

Radcliffe 5218.

	h.	m	s.
1883, Mar 22 s. p.	21	17	20.73
Apr. 2 s. p.			20.56
9 s. p.			20.53
10 s. p.			20.68
Nov. 8			20.41
16			20.67
17			20.65
19			20.36
Mean A. R. 1883.0	21	17	20.574

MEAN RIGHT ASCENSIONS FOR 1883.0. — *Continued.*

Radcliffe 5228.

	h.	m.	s.
1882, Oct. 14	21	18	9.23
21			9.38
Nov. 10			9.50
18			9.91
1883, Mar. 20 s. p.			10.23
Apr. 2 s. p.			9.74
13 s. p.			9.59
14 s. p.			9.79
Mean A. R. 1883.0	21	18	9.671

Groombridge 3548.

		s.
1882, Nov. 15	C. des T.	+0.12
16		—1.16
18		—0.28
20		—0.28
1883, Mar. 20 s. p.		—0.90
22 s. p.	[wt. = ½]	—1.02
Apr. 10 s. p.		—0.88
13 s. p.		—0.93
Oct. 16		—0.20
17		—0.65
18		—1.33
Nov. 5		—1.15
	Mean	—0.709
	C. des T.	46.40

	h.	m.	s.
Mean A. R. 1883.0	21	22	45.691

Bradley 2832.

	h.	m.	s.
1882, Nov. 20	21	22	53.69
21			53.30
1883, Mar. 20 s. p.			53.73
22 s. p.			53.82
Apr. 2 s. p.			53.49
9 s. p.			53.32
Nov. 7			53.46
8			53.39
27			53.11
28			53.60
Mean A. R. 1883.0	21	22	53.491

Groombridge 3511.

	h.	m.	s.
1882, Nov. 21	21	28	14.16
1883, Mar. 22 s. p.			14.20
Apr. 2 s. p.			14.00
9 s. p.			14.13
10 s. p.			14.36
Oct. 8			13.99
Nov. 7			13.98
8			14.00
19			14.10
Mean A. R. 1883.0	21	28	14.102

Cephei 32 H.

	h.	m.	s.
1883, Apr. 17 s. p.	22	22	27.68
Oct. 17			26.33
Nov. 27			26.24
28			26.81
Dec. 3			26.47
6			26.69
Mean A. R. 1883.0	22	22	26.703

Groombridge 3834.

		s.
1882, Dec. 9	A. E.	—0.11
1883, Oct. 17		—0.22
Dec. 6		—0.05
12		—0.28
	Mean	—0.165
	A. E.	12.987

	h.	m.	s.
Mean A. R. 1883.0	22	30	12.822

Piazzi XXII. 280.

	h.	m.	s.
1882, Nov. 4	22	50	18.83
10			20.00
16			19.55
Dec. 12 *			[20.98]
1883, Nov. 16			19.97
Mean A. R. 1883.0	22	50	19.588

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* This observation is provisionally excluded: all the observations of this date are more or less doubtful, owing to the fact that one end of the axis was not properly fastened, and the value of n which is to be here applied is very uncertain.

MEAN RIGHT ASCENSIONS FOR 1883.0. — *Continued.*

Cephei 36 H.

		h.	m.	s.
1882, Oct. 20		22	55	17.35
28				17.51
Nov. 10				17.69
21				18.08
1883, Oct. 16				17.46
17				17.51
Nov. 16				17.81
Dec. 12				18.13
Mean A. R. 1883.0		22	55	17.692

o Cephei.

		h.	m.	s.
1882, Oct. 28	A. E.			+0.02
Nov. 16				−0.10
18				−0.01
21				−0.10
1883, Nov. 16				−0.09
	Mean			−0.056
	A. E.			49.567
Mean A. R. 1883.0		23	13	49.511

Cephei 39 H.

		h.	m.	s.
1882, Oct. 20	C. des T.			−0.88
28				−1.26
Nov. 4				−0.27
10				+0.44
1883, May 18	s. p.			+1.19
19	s. p.			−1.65
Oct. 15				+0.59
Nov. 16				−0.07
Dec. 12				+0.15
15				+0.72
21				+0.15
	Mean			−0.081
	C. des T.			50.31
Mean A. R. 1883.0		23	27	50.229

Groombridge 4163.

		h.	m.	s.
1882, Oct. 20	A. E.			−0.48
28				−0.08
Nov. 4				−0.41
10				−0.33
18				−0.39
1883, Oct. 15				−0.03
	Mean			−0.287
	A. E.			9.173
Mean A. R. 1883.0		23	49	8.886

Bradley 3194.

	h.	m.	s.
1882, Oct. 28	23	54	0.93
Nov. 4			1.42
10			1.50
18			1.09
1883, Oct. 15			1.70
Dec. 26			1.71
29			1.65
Mean A. R. 1883.0	23	54	1.429

CATALOGUE OF MEAN RIGHT ASCENSIONS FOR 1883.0.

Name of Star.	No. Obs.	Mean A. R. 1883.0.	Epoch.	Annual Precession.	Approximate Declination.
		h. m. s.			° ′
Bradley 48	4	0 30 59.122	1883.9	+ 4.330	81 50.8
Bradley 74	6	44 0.495	1883.7	+ 5.172	83 4.3
Bradley 65	6	51 28.323	1883.7	+13.704	88 23.7
Bradley 95	4	56 38.390	1883.4	+ 8.453	86 31.3
38 Cassiopeiæ	4	1 22 32.547	1883.0	+ 4.343	69 39.7
Groombridge 339	4	36 54.928	1883.4	+11.683	86 21.2
Schwerd 75	4	44 2.060	1883.4	+19.212	87 55 2
Groombridge 424	5	55 4.912	1883.3	+ 7.017	80 44.1
Bradley 344	8	2 31 0.366	1883.3	+ 8.212	80 57.0
Groombridge 642	8	3 28 19.987	1883.2	+19.274	86 16.5
Groombridge 766	4	4 1 12.048	1883.6	+13.294	83 31.1
Groombridge 774	4	4 22.802	1883.6	+12.679	83 3 2
Groombridge 779	7	6 44.641	1883.0	+10.137	80 32.5
Groombridge 785	6	9 4.665	1883.4	+10.263	80 39.2
Radcliffe 1198*	7	16 12.719	1883.3	+10.351	80 37.3
Schwerd 241	4	17 29.715	1883.5	+14.144	83 47.2
Piazzi IV. 59	8	25 36.139	1883.3	+10.247	80 18.6
Piazzi IV. 77	8	28 37.021	1883.3	+10.377	80 25.6
Groombridge 848	5	33 6.516	1883.6	+ 7.954	75 43.5
Cephei 50 H.	8	38 30.224	1883.1	+10.981	80 59.8
Radcliffe 1311	6	50 27.600	1883.1	+20.457	85 48.2
Camelopardali 19 H.	9	5 3 17.922	1883.6	+ 9.799	79 5.6
Radcliffe 1377	5	4 13.934	1883.1	+19.806	85 34.0
Schwerd 306	4	7 32.792	1883.6	+14.973	83 45.4
Groombridge 966	6	24 5.011	1883.6	+ 7.988	74 57.8
Groombridge 944	6	24 37.782	1883.1	+18.588	85 8.0
Groombridge 1004	8	6 0 29.092	1883.1	+26.705	86 45.7
Schwerd 362	6	13 47.698	1883.5	+11.171	80 38.6
Schwerd 369	8	19 45.414	1883.4	+12.807	82 12.5
Schwerd 377	4	25 58.015	1883.6	+10.880	80 20.7
Camelopardali 23 H.	6	26 14.689	1883.7	+10.373	79 41.2
Camelopardali 24 H.	6	42 59.234	1883.7	+ 8.818	77 7.4
Groombridge 1255	8	7 3 6.902	1883.5	+11.646	81 28 0
Camelopardali 25 H.	14	6 23.397	1883.2	+12.981	82 38.0
Schwerd 406	5	9 10.546	1883.2	+16.169	84 26.0
Schwerd 415	5	11 25.706	1883.2	+12.397	82 13.8
Groombridge 1278	5	13 17.604	1883.7	+11.205	81 7.8
Schwerd 424	9	22 2.440	1883.5	+13.783	83 19.9
Camelopardali 28 H.	12	36 52.968	1883.3	+10.402	80 33.3
Groombridge 1119	12	38 44.02	1883.2	+71.047	88 58.6
Groombridge 1355	4	40 30.250	1883.7	+10.053	80 9.8
Groombridge 1368	9	46 20.127	1883.4	+ 9.715	79 47.8
Radcliffe 2020	6	46 45.597	1883.4	+20.293	86 1.9
Groombridge 1359	13	48 45.828	1883.3	+15.181	84 23.5
Groombridge 1391	11	8 1 46.863	1883.3	+12.182	82 47.4
Groombridge 1418	8	20 39.010	1883.0	+16.850	85 27.9
Groombridge 1431	8	25 6.781	1883.5	+11.427	82 39.0
Schwerd 529	8	38 31.751	1883.1	+11.655	83 9 5
Schwerd 533	8	41 15 820	1883.0	+11.607	83 11.3
Radcliffe 2218	9	50 44.090	1883.0	+13.562	84 38.9
Groombridge 1480	4	53 38.765	1883.3	+ 9.416	81 17.7
Schwerd 587	6	9 44 41.278	1883.6	+ 7.736	80 56.0
Radcliffe 2404	8	49 40.360	1883.6	+10.523	84 28.9
Radcliffe 2407	4	58 12.708	1883.4	+21.176	87 51.4

* Identical with Schwerd 242.

CATALOGUE OF MEAN RIGHT ASCENSIONS. — *Continued.*

Name of Star.	No. Obs.	Mean A. R. 1883.0	Epoch.	Annual Precession.	Approximate Declination.
		h. m. s.			° ′
Camelopardali 29 H.	12	10 12 26.892	1883.5	+ 9.775	84 50.7
Radcliffe 2594	6	11 0 18.173	1883.2	+14.507	88 16.5
Groombridge 1782	4	23 32.415	1882.8	+ 4.537	81 46.3
Groombridge 1850	4	58 50.642	1883.4	+ 3.175	86 14.1
Bradley 1656	5	12 13 25.256	1883.8	+ 1.535	87 5.2
Bradley 1672	11	14 20.60	1883.4	+ 0.172	88 20.9
Groombridge 1923	6	37 32.972	1883.4	+ 0.893	84 17.2
Groombridge 1927	7	41 27.780	1883.6	+ 1.507	81 15.8
Camelopardali 32 H.	14	48 16.332	1883.3	+ 0.391	84 2.9
Groombridge 2006	6	13 7 6.792	1883.	— 9.756	88 16.6
Groombridge 2007	8	19 22.211	1883.7	— 2.527	85 22.0
Groombridge 2063	5	45 43.634	1883.	— 2.024	83 20.4
Groombridge 2071	4	52 44.675	1883.	— 1.076	81 20.6
Groombridge 2099	9	14 1 28 637	1883.2	— 7.430	86 19.1
5 Ursæ Minoris	4	27 47.223	1883.5	— 0.203	76 13.0
Groombridge 2196	7	58 18.173	1883.3	— 4.560	82 59.5
Groombridge 2213	4	15 3 33.850	1883.3	— 6.723	84 24.2
Groombridge 2283	8	15 20.01	1883.3	—21.783	87 40.9
11 Ursæ Minoris	4	17 11.818	1883.5	— 0.094	72 14.9
Groombridge 2275	6	36 1.500	1883.	— 3.632	80 50.1
Groombridge 2276	6	36 14.158	1883.	— 3.637	80 50.2
Radcliffe 3445	4	37 2.932	1883.5	— 3.905	81 9.6
Schwerd 932	4	44 2.678	1883.5	— 3.915	80 59.1
Radcliffe 3475	4	45 22.802	1883.5	—10.207	85 12.6
18 Ursæ Minoris	5	46 6.074	1883.5	— 3.485	80 20.9
Schwerd 945	4	52 36.545	1883.5	— 4.337	81 17.2
Groombridge 2315	8	55 38.995	1883.3	— 6.672	83 17.9
A Draconis	5	16 28 13.109	1883.6	— 0.138	69 1.3
Schwerd 988	4	36 4.078	1883.5	— 8.710	83 57.1
Schwerd 986	4	38 53.132	1883.	— 4.062	80 1.9
Schwerd 1016	4	17 6 13.538	1883.6	— 5.160	81 1.5
Groombridge 2456	6	28 29.895	1883.4	— 4.625	80 14.3
Groombridge 2476	6	35 2.508	1883.4	— 8.460	83 25 6
ψ Draconis (S. Star)	7	44 1.462	1883.6	— 1.083	72 12.4
Schwerd 1059	4	51 26.282	1883.6	— 4.760	80 19.2
35 Draconis	7	54 41.363	1883.6	— 2.706	76 58.6
40 Draconis	4	18 8 47.685	1883.6	— 4.491	79 59.0
41 Draconis	6	8 53.892	1883.6	— 4.494	79 59.2
24 Ursæ Minoris	12	14 6.154	1883.5	—22.300	86 59.4
χ Draconis	13	23 9.947	1883.7	— 1.193	72 40.9
Radcliffe 3961	8	24 3.901	1883.4	— 5.743	81 25.4
Bradley 2412	12	39 34.600	1883.3	— 7.788	83 5.2
50 Draconis	4	50 8.524	1883.7	— 1 900	75 17.7
Radcliffe 4208	5	53 2.074	1883.0	—18.568	86 33.5
υ Draconis	6	55 49.637	1883.8	— 0.726	71 . 8.4
Radcliffe 4253	4	19 6 28.100	1883.8	— 8.612	83 44.6
Radcliffe 4300	6	15 38.907	1883.7	— 4.510	80 31.8
Radcliffe 4313	6	16 48.533	1883.7	— 4.514	80 33.0
τ Draconis	5	17 47.645	1883.8	— 1.087	73 8.3
Groombridge 2900	8	28 45.021	1883.8	— 3.521	79 22.0
Schwerd 1172	11	30 2.651	1883.3	— 7.335	83 14.0
κ Cephei	6	20 12 48.435	1883.8	— 1.915	77 21.5
Groombridge 3402	8	13 26.772	1883.5	—49.185	88 46.6
Groombridge 3212	13	16 18.289	1883.2	— 8.072	84 19.5

CATALOGUE OF MEAN RIGHT ASCENSIONS. — *Continued.*

Name of Star.	No. Obs.	Mean A. R. 1883.0.	Epoch.	Annual Precession.	Approximate Declination.
		h. m. s.			° ′
Schwerd 1213	9	20 21 4.230	1883.0	— 3.224	80 9.9
Groombridge 3260	10	26 35.417	1883.4	— 7.435	84 10.3
Groombridge 3261	7	30 0.303	1883.5	— 4.459	81 59.0
Bradley 2673	8	30 30.29	1883.2	— 0.213	72 8.1
Bradley 2701	12	34 9.950	1883.3	— 3.556	81 2.1
75 Draconis	8	35 31.666	1883.0	— 3.514	81 1.3
Schwerd 1235	5	35 51.364	1883.6	— 5.139	82 47.1
74 Draconis	8	36 10.475	1883.0	— 3.255	80 40.9
Radcliffe 4976	8	40 39.904	1883.0	— 5.518	83 13.1
Schwerd 1255	5	21 0 26.958	1883.9	— 5.193	83 29.3
Schwerd 1258	5	8 48.610	1883.4	— 2.464	80 41.2
Schwerd 1260	8	11 44.330	1883.6	— 2.304	80 32.5
Radcliffe 5218	8	17 20.574	1883.6	— 2.032	80 18.9
Radcliffe 5228	8	18 9.671	1883.0	— 2.248	80 44.4
Groombridge 3548	12	22 45.70	1883.3	—10.978	86 33.0
Bradley 2832	10	22 53.491	1883.4	— 4.673	83 45.8
Groombridge 3511	9	28 14.102	1883.5	— 1.596	80 0.9
Cephei 32 H.	6	22 22 26.703	1883.8	— 3.971	85 31.1
Groombridge 3834	4	30 12.821	1883.7	+ 1.081	75 37.4
Piazzi XXII. 280	4	50 19.588	1883.1	— 0.838	84 9.4
Cephei 36 H.	8	55 17.692	1883.3	— 0.312	83 43.2
o Cephei	5	23 13 49.512	1883.1	+ 2.427	67 28.3
Cephei 39 H.	11	27 50.264	1883.4	— 0.133	86 39.7
Groombridge 4163	6	49 8.886	1883.0	+ 2.855	73 45.6
Bradley 3194	7	54 1.429	1883.3	+ 2.567	86 3.3

In forming this catalogue the stars from the Berlin Jahrbuch were reduced to the fraction of the year *here* given by the proper motion from "Publication XIV. der Astronomischen Gesellschaft." For one star, χ Draconis, the true fraction .74 would have made a difference of some thousandths in the result.

For certain stars taken from the American Ephemeris, or its supplements, a similar course was followed. Those taken from the "Connaissance des Temps" were additionally corrected for omitted terms of some trifling importance in the nutation. They are, —

$$\begin{aligned} &-0.00295 \sin(\odot + 82^\circ.2)\, a \\ &+0^s.009 \cos(\odot + 280^\circ.9)\, b \\ &-E \end{aligned}$$

The first term, the only one at all sensible, is tabulated in the Annals of the Harvard College Observatory, Vol. IV., part 2, page xix.

The supposed annual proper motions thus eliminated for the stars of the American and French ephemerides are as follows: —

	s.		s.
38 Cassiopeiæ	+0.025	Groombridge 2283	+0.089*
Groombridge 944	+0.020	50 Draconis	—0.004
Camelopardali 25 H.	+0.009	Groombridge 3548	+0.043*
Groombridge 1119	—0.348*	Groombridge 3834	—0.001
Bradley 1672	—0.144*	*o* Cephei	+0.014
Camelopardali 32 H.	—0.012	Cephei 39 H.	+0.085
5 Ursæ Minoris	+0.005		

Where these proper motions are sensibly erroneous, usually too large, the true fractions of the year were employed; so that in no case will sensible error arise from employing the fractions to tenths only.

It is well known that the right ascensions of polar stars as determined by different astronomers seem to be affected by a different personal equation from equatorial stars. Thus, for instance, the stars determined by M. Gonnessiat, at Lyons, for 1883.0 (Comptes Rendus, for August 13, 1883) compare as follows with the right ascensions of the Berlin Jahrbuch and those of the present paper; G. denoting the Lyons observations, B. the values given by the Jahrbuch, and S. those here given.

	G.	B.	S.	B. — G.	S. — G.
	h. m. s.	s.	s.	s.	s.
Cephei 43 H.	0 52 57.60	57.87	....	+0.27	....
α Ursæ Minoris	1 15 51.92	51.88	....	—0.04	....
Groombridge 750	4 0 13.64	13.84	....	+0.20	....
Cephei 51 H.	6 45 16.28	16.79	....	+0.51	....
Groombridge 119	7 38 43.51	....	44.02	....	+0.51
Draconis 1 H.	9 20 18.30	18.31	....	+0.01	....
Bradley 1672	12 14 20.17	....	20.60	....	+0.43
Groombridge 2283	15 15 19.86	....	20.01	....	+0.15
ε Ursæ Minoris	16 57 59.49	59.85	....	+0.36	....
δ Ursæ Minoris	18 10 3.31	3.80	....	+0.49	....
λ Ursæ Minoris	19 41 1.43	2.28	....	+0.85	....
Bradley 2701	20 34 9.50	....	9.95	....	+0.45
Groombridge 3548	21 22 45.42	....	45.70	....	+0.28
Cephei 32 H.	22 22 26.11	....	26.70	....	+0.59
Cephei 39 H.	23 27 49.91	....	50.26	....	+0.35

The tendency to the positive sign, both in B. — G. and S. — G. is here unmistakable. If we assume (the propriety of this assumption might perhaps be questioned) that these values are mainly proportional to the secant of the declination, we shall have, —

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* From the "Annales du Bureau des Longitudes."

	Decl.	$\Delta\alpha \cos\delta$ B.— G.
	°	s.
Cephei 43 H.	85.63	+0.021
α Ursæ Minoris	88.69	—0.001
Groombridge 750	85.25	+0.017
Cephei 51 H.	87.23	+0.025
Draconis 1 H.	81.84	+0.001
ε Ursæ Minoris	82.23	+0.049
δ Ursæ Minoris	86.61	+0.029
λ Ursæ Minoris	88.95	+0 016
Mean		s. +0.020±0.0038

P. E. 1 value $\pm 0^s.0107$

	Decl.	$\Delta\alpha \cos\delta$ S. — G.
	°	s.
Groombridge 1119	88.98	+0.009
Bradley 1672	88.35	+0.012
Groombridge 2283	87.68	+0.006
Bradley 2701	81.04	+0 070
Groombridge 3548	86.55	+0.017
Cephei 32 H.	85.52	+0.046
Cephei 39 H.	86.66	+0 020
Mean		s. +0 026±0.0058

P. E. 1 value $\pm 0^s.0154$

So far as these observations go, there is no personal difference indicated with certainty between B. and S. I am, however, inclined to think that there may be a trifling one of the same order as that apparent; namely, S. — B. $= +0^s.005$ (with a probable error of $\pm 0^s.0069$ however); but I have not been able absolutely to prove its existence.

A somewhat plausible hypothesis, not usually adopted, is that for high northern declinations the ordinary probable error, due somewhat to the rapidity of the motion of equatorial stars, ceases to hold good. This hypothesis is somewhat favored by the fact that Bessel's time determinations with the Reichenbach circle differed from Struve's by a large amount, — more than one second; and that the difference between the right ascensions of Polaris and δ Ursæ Minoris, as determined by these two distinguished astronomers, seems to be due mainly to their clock corrections. In other words, they observed the polars alike, equatorial stars in an unlike manner.

On this theory M. Gonnessiat's clock corrections would be too small relatively to the Jahrbuch standard observer (Wagner) by $+0^s.33$; relatively to mine, by $+0^s.39$. After subtracting these numbers the remaining probable errors of one star, reduced to the equator, would be $\pm 0^s.013$ and $\pm 0^s.006$ respectively. The first number, however, would be reduced to a less quantity if the right ascension of Draconis 1 H. given in B. were corrected by the amount

$$+0^s.166 + 0^s.0097\ (\lambda - 1875),$$

which I have elsewhere indicated as probable; this value has been since very nearly confirmed by Pulcova observations for 1875.0 and 1880.0, which I owe to Vice-Director Wagner's kindness.

These values are, —

	M. Eq.	No. Obs.	A. R. h. m. s.	Correction to Publ. XIV. s.
Wagner 1875.0	1875.0	12	9 19 5.967	+0.227
" 1880.0	1880.0	4	19 51.44	+0.284

Applying, then, the correction $+0^{\mathrm{s}}.24$ to the Jahrbuch position for 1883.0, but adopting the first hypothesis, that the personal equation is directly proportional to sec. δ and overlooking the difference of equinox with G. altogether, we find

$$\begin{aligned} &\text{B.} - \text{G. } \Delta\alpha \cos\delta \text{ (in mean)} = +0^{\mathrm{s}}.024; \\ &\text{probable error of one star } = \pm 0^{\mathrm{s}}.010. \end{aligned}$$

On the second hypothesis, that the constant error is due to clock correction, but omitting its uncertainty in calculating the probable error, that is, multiplying the individual residuals by $\cos\delta$ before calculating their sum of squares, we find

$$\text{B.} - \text{G. } (\Delta\alpha) = +0^{\mathrm{s}}.36\text{; p. e. of one star } \epsilon \cos\delta = \pm\, 0^{\mathrm{s}}.007.$$

For both B. — G. and S. — G. this hypothesis is rather more favorable than the other, but the evidence is yet far too scanty.

In fact, one object of the present publication is to induce the collection of more observations of these stars, and others at a somewhat greater distance from the pole. I find incidentally that a considerable portion of the stars of the present catalogue are now elsewhere in process of observation.

A form of personal equation has lately been noticed by Mr. Gill, which has some bearing here, — the difference in clock correction as the star seems to move eastward or westward. Of this I have as yet but trifling indications in my own case. As its cause is probably identical with that which makes it difficult to bisect an interval by the eye when the objects are at rest, it will have no more effect on the time of transit of a polar star than on that of an equatorial one, but will tend to produce difference (as Mr. Gill has found it to do) between the clock corrections from stars north and stars south of the zenith; it will also tend to produce difference between the resulting right ascensions of stars from observations above and below pole. This last difference I have found for these declinations to be imperceptible; but the half-difference of clock corrections is yet to be applied, as all my clock stars have been south of the zenith. So that the personal equations derived from this cause are probably either too small to be sensible in these declinations, or are merged in the form of personal equation discussed above.

The employment of Mr. Gill's reversing prism would perhaps be desirable in the continuation of this series.

The probable error of a single observation of a star within 10° of the north pole has been found to be rather less since the counterpoises were adjusted, in May; and a still further decrease has been indicated since the object-glass and eyepiece were exchanged in September. The illumination of the field, as before stated, has been more satisfactory.

I find from a great number of stars the following values reduced to the equator: —

	$\epsilon \cos \delta$.	
1882 — 1883, April 17,	$\pm 0^s.0267$	(64 stars).
1883, May 9 — 1883, Dec. 31,	$\pm 0^s.0196$	(69 stars).

These values, however, are obtained by comparing observations in the same position of the instrument.

For the whole time I find by 49 stars the value

$$\epsilon \cos \delta = \pm 0^s.0238$$

from observations in two or three positions indifferently; a value which is very little larger than the average of the values which precede.

There are not enough stars beyond 10° from the pole to give an accurate value of the probable error, which in this region is somewhat increased; nor have I yet divided those within 10° into zones of declination.

From 46 stars observed since Sept. 5, 1883, only, I find

$$\epsilon \cos \delta = \pm 0^s.0161,$$

and it is quite possible that this smaller probable error may hold good for present and future observations, so long as the instrument remains in its present normal condition; the relative weights of the different periods will, however, be better discussed when more materials are available; and especially when a sufficient number of stars have been observed in four or more positions.

Another question deserves investigation: whether the personal equation for polar stars changes from time to time. I conceive, however, that the study of this point must at present be deferred. The simplest and best method to determine it will be to compare observations of successive whole years. I do not imagine that the reversal of object-glass and eyepiece would, by bringing into use new parts of the pivots, produce a supposititious personal equation of this sort in a series of observations so entirely differential in character as the present; and the second complete year will not be finished till July, 1884.

In the attempt to compare the present observations with similar ones of earlier dates I was at once met with the difficulty arising from the lack of exact proper motions. The two early catalogues which are most available for their computation are Auwers's Bradley and Struve's Dorpat Observations of 1814–15. But I have not yet had time to complete the long calculations necessary for this purpose. The plan which I have formed is, first, to reduce to a fixed epoch all observations of these close polars which are free from dependence upon a meridian mark of the old fashion; omitting especially Fedorenko, Piazzi, Groombridge, and Pond, all of which require either large systematic corrections or frequent allowance for abnormal discrepancy. The better catalogues, without especial systematic correction, will give by least squares values of the proper motions, which will contain the personal equations, it is true, but the residual errors will afford some guide to their signs and amounts. The process would be analogous to that which Professor Newcomb has employed for standard right ascensions and Professor Boss for standard declinations; that is, in the least-square solution, one part of the chance errors for any given star is owing to the systematic error of the catalogues employed. It is of course impossible in this way to obtain the absolute values of the systematic corrections, and quite likely that the final results will not agree any better than if two catalogues, an old and a new one, were arbitrarily adopted as the basis for these corrections; but the method has at least the merit of exhibiting such discrepancies as really exist, and of showing what parts of the problem are for the time being absolutely insoluble. The observations of the next half-century are in fact necessary for its complete solution. It is my intention to continue these calculations, which have been long begun, and in which I have been assisted by one or two of my former pupils.

A rather serious stumbling-block in this matter, which will for a long time to come make it difficult to obtain exact reductions from one standard to another, and still more difficult to find a standard which is not in some degree arbitrary, lies in the relation between Bradley and Struve. For stars so near the pole as these, Bradley's observations give larger right ascensions than Struve's of 1814–15, so that, as Mädler has long ago pointed out, considerable positive reductions are needed to reduce the latter to the standard which he adopted, — the *Positiones Mediæ.* Whether this standard was held to by him close enough is somewhat doubtful; there seems, however, to be no doubt that an interpolation between Bradley and the modern catalogues to the epoch of Struve's earlier work would give on the whole somewhat greater right ascensions of the stars of my list than Struve himself, even after the systematic corrections used by Argelander, which are derived from adopted positions of the clock stars, were applied.

In other words, the distribution of the early observations of any given polar is apt to be so irregular that any least-square solution will give somewhat uncertain results; and it will not be soon possible to arrange a really normal catalogue for these, any more than for other needed stars; a difficulty which in this case is aggravated by the small number of those objects in the critical positions which have been frequently enough observed.